

A REPORT ON THE STATUS OF CHRISTIE LAKE, COUNTY OF LANARK, PERTH, ONTARIO

July, 1972



Ontario

Ministry
of the
Environment

The Honourable
William G. Newman,
Minister

Everett Biggs,
Deputy Minister

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A REPORT ON THE STATUS
OF CHRISTIE LAKE, COUNTY OF
LANARK, PERTH, ONTARIO

by
R. J. Stedwill
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Previously
Biology Branch
Ontario Water Resources Commission

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INTRODUCTION

Over the past few years an increasing awareness and concern for problems of pollution in recreational lakes has materialized as a consequence of accelerated cottage development. Many individual cottagers, cottage associations' and permanent shoreline residents have requested that complete water quality evaluations be carried out to assess the degree of pollution in lakes. Exhaustive physical, chemical, bacteriological and biological evaluations for a large number of lakes are beyond the financial and logistical capabilities of personnel involved in water management programmes, and in light of recent studies, are not necessary in order to categorize the quality of recreational waters. In 1971, a practical but effective evaluation programme was carried out on approximately thirty recreational lakes in the Province of Ontario.

The programme, which involved the collection of data on water clarity and algal populations, was highly successful owing to the enthusiastic efforts of local residents, cottagers, marina and resort owners, Conservation Authorities and personnel of the ministries of Natural Resources and the Environment.

METHODS

Secchi disc readings and chlorophyll samples were taken weekly or as often as possible. The Ministry of the Environment gratefully acknowledges the assistance of Dr. M. Dickman and Mr. F. McFarland who collected the water samples from Christie Lake.

Secchi disc measurements were made by lowering the disc into the water on the shaded side of the boat and recording the depth at which the alternating black and white quadrants just disappeared. The disc was then lowered a short distance and raised slowly until the black and white segments were again visible. A second reading was then taken. A mean of the two readings was the Secchi disc depth.

Chlorophyll samples were taken by lowering a 32 ounce bottle provided with a restricted opening to the approximate location of the 1% incident light level determined as twice the Secchi disc. The sample was immediately preserved with 10 - 15 drops of a 2% magnesium carbonate solution and rapidly transported to the laboratories in Toronto for analysis.

SIGNIFICANCE OF CHLOROPHYLL a AND SECCHI DISC

Chlorophyll a measures the amount of photosynthetic green pigment in algae while the Secchi disc determines water transparency. Thus, the amount of chlorophyll and corresponding Secchi disc depth can be used to reflect the degree of aquatic enrichment in a lake at the time sampling. Chlorophyll levels as well as Secchi disc depths do not remain constant through the summer months but fluctuate due to environmental factors (physical, chemical and biological). For example, the highest chlorophyll values and lowest Secchi disc readings are generally expected in early spring as well as in August through early September.

The chlorophyll a test is limited to a degree as concentrations less than 2.0 ug/l are below the lower analytical limit of the test.

Values in the 2.0 - 5.0 ug/l range are low and indicate low to moderate algal populations. Concentrations between 5.0 and 10.0 ug/l, although moderately high, may be considered acceptable for most water-oriented recreational pursuits. Levels between 10.0 and 15.0 ug/l reflect high algal levels and greater than 15 ug/l indicates nuisance levels of algae. At these higher levels; severe degradation of recreational activities will result as well as the retardation of aesthetic water quality.

RESULTS AND DISCUSSIONS

The chlorophyll a concentrations and Secchi disc readings collected during 1971 on Christie Lake, Lanark County, are presented in Table I. On the basis of the limited data received, chlorophyll a values were extremely low and reflect sparse algal densities.

Brown (1972) has indicated that a hyperbolic-like relationship exists between chlorophyll a concentrations and Secchi disc readings for lakes of Precambrian origin. Figure I describes the author's mathematical relationship between chlorophyll a and Secchi disc for 945 sets of data collected from approximately sixty recreational lakes located primarily in Southern Ontario. Points for eutrophic lakes which are characterized by high chlorophyll a concentrations and poor water clarity are situated along the vertical axis of the curve while oligotrophic waters which have low chlorophyll a levels and allow a greater proportion of light penetration lie along the horizontal limb. Data for mesotrophic lakes would be dispersed about the middle section of the curve. On the basis of the data collected, Christie Lake would be oligotrophic. The lake was well-removed from Bay of Quinte, Riley Lake, the Western Basin of Lake Erie and Gravenhurst Bay - four extremely enriched bodies of water. Some caution, however, should be exercised when considering the relative position of Christie Lake, as only mid-summer data were available for incorporation into the model.

Property owners and cottagers should be aware that unless artificial nutrients are kept from gaining access to the bays, future water quality will most certainly be undermined. In this connection every effort should be made to ensure that nutrients from sink and laundry wastes, as well as seepage from septic tank systems do not gain access to the lakes.

The use of washing compounds containing phosphates should be avoided by residents. Most household liquid dishwashing products do not contain phosphates and therefore do not contribute to algal growth. If clothes washing is carried out at cottages, it is not necessary to use granular detergents containing phosphates, since ordinary soap products perform adequately in soft-water Pre-cambrian lakes. Although the phosphate content of all household detergents has been reduced to approximately 20% as P_2O_5 (effective August, 1970) and to less than 5% by the end of 1972, the exclusive use of laundry soaps would provide a significant reduction in the potential enrichment by phosphates.

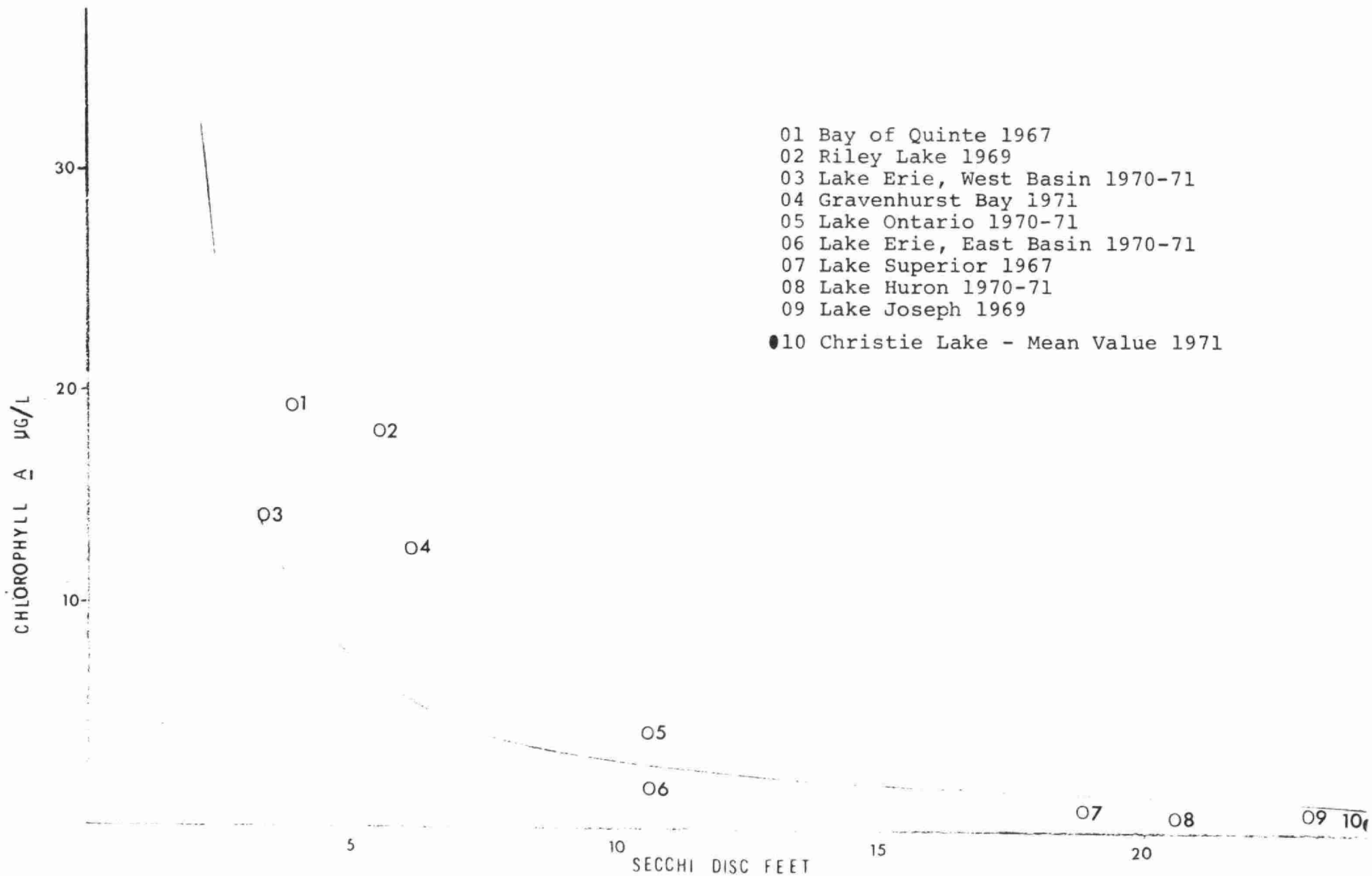


Figure 1: The relationship between chlorophyll a and Secchi discs determined from Ontario Lakes surveyed in 1971. Mean chlorophyll a - Secchi disc values collected during 1971 on Christie Lake are presented.

CHRISTIE LAKE

CHLOROPHYLL-SECCHI DISC DATA 1971

<u>DATE</u>	<u>SECCHI DISC</u>	<u>CHLOROPHYLL a</u>
July 8	21'4"	0.8
July 15	27'0"	0.5
July 21	28'2"	0.4
July 28	22'8"	0.3

TABLE 1: Chlorophyll "a" (ugm/l) and Secchi disc values (feet) for Christie Lake, Lanark County.

GLOSSARY OF TERMS

- ALGAE - An assemblage of simple, mostly microscopic non-vascular plants containing photosynthetic pigments such as chlorophyll. Algae occur suspended in water (phytoplankton) and attached to rock and other suitable substrates. Some algae may produce nuisance conditions when environmental parameters are suitable for prolific growth.
- CHLOROPHYLL - the photosynthetic green pigment which occurs in all algal divisions.
- EUPHOTIC ZONE - the lighted region that extends vertically from the water surface to the level at which photosynthesis fails to occur due to insufficient light penetration.
- EUTROPHIC - waters containing advanced nutrient enrichment and characterized by a high rate of organic production.
- EUTROPHICATION - the process of becoming increasingly enriched in nutrients. It refers to the entire complex of changes which accompanies increasing nutrient enrichment. The results is the production of dense nuisance growths of algae and aquatic weeds which generally degrade water quality and render the lake unsuitable for many recreational activities.
- MESOTROPHIC - waters characterized by a moderate nutrient supply and organic production (i.e. midway between eutrophic and oligotrophic).
- OLIGOTROPHIC - waters containing a small nutrient supply and consequently characterized by low rates of organic production.
- SECCHI DISC - a circular metal plate, 20 centimeters in diameter, the upper surface of which is divided into four equal quadrants and so painted that two quadrants directly opposite each other are painted black and the intervening ones white. The Secchi disc is used to estimate the depth of the euphotic zone.

TROPHIC STATUS - depending upon the degree of nutrient enrichment and resulting biological productivity, lakes are generally classified into three intergrading types: oligotrophic, mesotrophic and eutrophic. If the supply of nutrients to an oligotrophic lake is progressively increased, the lake becomes more mesotrophic in character; with continued enrichment it will become eutrophic.

ug/l - micrograms per litre or parts per billion.

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